REMARKS

Claims 1-18 are pending in this application, with the original numbering of the claims being in error due to the duplication of numeral 16 on two consecutive claims. Claims 13-18 are withdrawn from consideration. Claims 8 and 10 are rejected under 35 USC 102(b) as being anticipated by Konecni. Claims 8, 9, 11 and 12 are rejected under 35 USC 102(b) as being anticipated by Hieda or Meikle. Claim 1 is rejected under 35 USC 102(e) as being anticipated by Brennan. Claims 1-5 and 7 are rejected under 35 USC 103(a) as being unpatentable over Yamashita in view of Meikle. Claim 6 is rejected under 35 USC 103(a) as being unpatentable over Yamashita and Meikle and further in view of Konecni.

Claims 6 and 8-17 are cancelled herein. This renders moot all of the rejections except for the rejection of claim 1 under 35 USC 102(e) and the rejection of claims 1-5 and 7 under 35 USC 103(a).

Claim 1 has been amended herein to eliminate the limitation that the polish stop layer may comprise titanium carbon nitride (TiCN), but retaining the limitation that the polish stop layer comprises titanium aluminum nitride (TiAlN). This amendment overcomes the rejection of claim 1 under 35 USC 102(e), since Brennan does not teach or suggest a polish stop layer comprising titanium aluminum nitride (TiAlN).

The applicants traverse the rejection of claims 1-5 and 7 under 35 USC 103(a) as being unpatentable over Yamashita in view of Meikle. The Examiner states that Meikle teaches that aluminum doped TiN is known to be used in place of TiN. However, the aluminum doped TiN (TiAlN) material is used by Meikle as a barrier material for preventing the interdiffusion of silicon and aluminum at the silicon/aluminum interface. (see the Abstract) Meikle does not teach or suggest the use of TiAlN as a polish stop layer. Rather, Meikle selects TiAlN over TiN for the barrier material because it is more resistant to diffusion than TiN. (Abstract and column 2, lines 30-34)

Neither Yamashita nor Meikle recognizes the problem solved by the present invention. Furthermore, Meikle fails to appreciate the useful differences between TiN and TiAlN as material removal process stop layers. In fact, Meikle actually teaches

away from the invention of claim 1 by stating that "TiAlN etches readily in NH_4OH/H_2O_2 similar to TiN". (column 2, lines 35-36) Thus, Meikle provides no motivation for using TiAlN in the device of Yamashita in order to improve its polish stop performance. The fact that Meikle teaches that TiAlN is more resistant to diffusion than TiN provides no motivation to combine Meikle with Yamashita to solve the problem solved by the present invention, since it is well known in the art that diffusion properties and polish stop properties are completely different properties and that they are not necessarily related. Thus, the Examiner has failed to establish a prima facie case for obviousness, and reconsideration of the rejection of claims 1-5 and 7 under 35 USC 103(a) is respectfully requested. The applicants believe that amended claim 1 and its dependent claims 2-5 and 7 are now in condition for allowance.

New claims 19 and 20 have been added herein. These claims include the limitations of a polish stop layer comprising titanium nitride alloyed with carbon (TiCN)...wherein the polish stop layer has a hardness which is 30 to 35 percent greater than a hardness of titanium nitride alone for protecting (an underlying) dielectric layer from a chemical mechanical polishing process used to remove a portion of (an overlying) metal layer. Nothing in the prior art teaches or suggests the combination of limitations of independent claim 19 or dependent claim 20.

In particular, the device of Koeneci contains no teaching of the hardness of TiCN as compared to that of TiN, nor does Koeneci suggest using TiCN as an improved etch stop layer as a result of this difference. The TiCN layer of Koeneci is a top barrier layer disposed over an aluminum plug to prevent electro-migration failure of the aluminum plug during a subsequent annealing process. There is no suggestion in Koeneci that TiCN may be used as an etch stop layer. Since Koeneci fails to recognize the problem solved by the present invention, there is no motivation to combine Koeneci with another patent to solve such problems.

Hieda, Yamashita and Meikle contain no discussion regarding TiCN.

Brennan teaches away from independent claim 19 by describing the carbon content of TiCN as "deleterious" and by teaching a subsequent plasma treatment to remove the carbon from the TiCN adhesion layer. (column 4, line 63-67 and column 5, lines 20-37) Furthermore, after the plasma carbon removal process, the adhesion layer

28 of Brennan is purposefully removed from the surface of the underlying dielectric layer 20, as illustrated in FIGs. 5 and 6 of Brennan. This is made easier because the carbon content of the adhesion layer 28 is reduced to about 5%. This is in contrast to the carbon content between about 5 and 20 percent of claim 20. Thus, new claims 19 and 20 are believed to be in condition for allowance.

New claim 21 has been added herein and it includes the limitations of: a layer of titanium aluminum nitride (TiAlN) disposed on a metal layer; a dielectric layer disposed on the layer of TiAlN; a patterned layer of photoresist disposed on the dielectric layer exposing a selected portion of the dielectric layer to an etching process; wherein the layer of TiAlN functions as an etch stop layer upon removal of the selected portion of the dielectric layer to prevent the etching process from compromising the underlying metal layer. Nothing in the cited prior art teaches or suggests disposing a layer of TiAlN under a dielectric layer that is selectively exposed to an etching process through a patterned photoresist layer in order to protect an underlying metal layer. Koeneci, Hieda and Meikle describe TiAlN only as a diffusion barrier material. Meikle actually teaches away from this claim by stating that TiAlN etches like TiN, whereas the present applicants have appreciated the significantly different etch properties of these two materials and have claimed a device that exploits the unique properties of TiAlN. Brennan does not mention TiAlN. Thus, new claim 21 is believed to be in condition for allowance.

Page 1 of the specification has been amended to include the application number of the provisional patent application from which priority is claimed.

Reconsideration of the application and allowance of claims 1-5, 7, and 19-21 is respectfully requested in light of the above amendments and remarks.

Respectfully submitted,

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